1. Compute the following indefinite integral:

$$\int x\sqrt{x^2 - 1}\ \mathrm{d}x.$$

2. Given the function

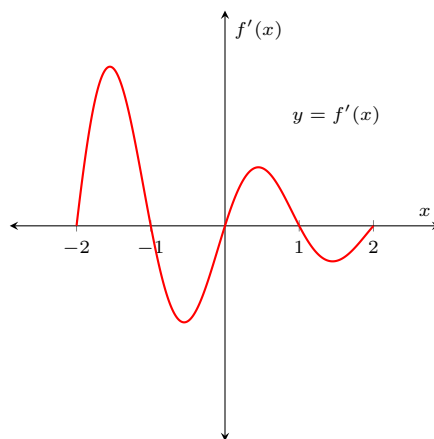$$F(x) = \int_0^{x^2} \sin^2(t)\mathrm{d}t,$$

   determine $F'(x)$.

3. Determine if the series

$$\sum_{n=0}^{\infty} \frac{1 + \sin(n)}{10^n}$$

   converges or not.

4. For a function $f(x)$, the graph of its derivative, $f'(x)$, is given below:

   Determine the following:

   (a) On what intervals if $f(x)$ increasing? Decreasing?

   (b) At what value of x does $f(x)$ have a local maximum? Local minimum?

   (c) If it is known that $f(0) = 0$, sketch a possible graph of $f(x)$.